

The screenshot shows the go2MONITOR software interface. The main window displays a decoded ADS-C message from an aircraft. The message is titled "Downlink GndId: 05 AirId: 158 FlightId: AIC302". The message content is as follows:

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/ AKLCDYA.ADS.CC-
BGL07DE4C0C78164946F60D1F0DDE93EC71C709470199E0000438E38947000E69A8E1C0000F6791A580001034BF5DFCD78E
ADS-C message:
Basic report:
Lat: -47.3948479
Lon: -158.8909721
Alt: 37996 ft
Time: 3459.250 sec past hour (:57:39.250)
Position accuracy: <0.05 nm
NAV unit redundancy: OK
TCAS: OK
Predicted route:
Next waypoint:
Lat: -47.0000267
Lon: -160.0000763
Alt: 38000 ft
ETA: 409 sec
Next+1 waypoint:
Lat: -45.0000000
Lon: -170.0000381
Alt: 38000 ft
Earth reference data:
True track: 297.2 deg
Ground speed: 451.5 kt
Vertical speed: 0 ft/min
Air reference data:
True heading: 291.3 deg
Mach speed: 0.8430
Vertical speed: 0 ft/min
Meteo data:
Wind speed: 52.5 kt
True wind direction: 355.8 deg
Temperature: -64.50 C
HACARS mode: 2 Aircraft reg: .CC-BGL
Message label: H1 Block id: 8 Msg. no: F00A Flight id: LA0801
Message content:
#M1BPOSS45001W170001,S45000W170000,150430,380,CI,154410,GUMKO,M64,23960,654/TS150430,1904220194
HACARS mode: 2 Aircraft reg: .CC-BGL
Message label: 83 Block id: 6 Msg. no: M03A Flight id: LA0801
Message content:
SCEL,NZAA,191227,-52.51,-141.97,36000,280,-103.9,43500
/CG 017.30/CI 00042/PH ****/FEL 023870/FER 023719/GW 0202231/ZFW 0159043
SCEL,NZAA,191242,-51.64,-145.07,35999,281,-101.0,42200
/CG 017.30/CI 00042/PH ****/FEL 024539/FER 024383/GW 0200898/ZFW 0159043
SCEL,NZAA,191257,-50.69,-148.03,36000,282,-98.1,40800
/CG 017.30/CI 00042/PH ****/FEL 025210/FER 025049/GW 0199563/ZFW 0159043
SCEL,NZAA,191312,-49.78,-150.90,37975,269,-103.9,39500
/CG 017.30/CI 00042/PH ****/FEL 025911/FER 025745/GW 0198167/ZFW 0159043
SCEL,NZAA,191327,-49.03,-153.70,38000,269,-100.9,38300
/CG 017.30/CI 00042/PH ****/FEL 026552/FER 026381/GW 0196888/ZFW 0159043
SCEL,NZAA,191342,-48.24,-156.35,38001,269,-100.3,37000
/CG 017.30/CI 00042/PH ****/FEL 027188/FER 027012/GW 0195624/ZFW 0159043
SCEL,NZAA,191357,-47.40,-158.87,38000,269,-97.1,35500
/CG 017.30/CI 00042/PH ****/FEL 027828/FER 027646/GW 0194347/ZFW 0159043
/NZAA.AFN/FMHLAN801,.CC-BGL,E80452,150849/FPOS44544W170427,1/FCOATC,01/FCOADS,01EFE3
#M1BPRG/TS151036,190422/DTNZAA,05R,466,171035,041/FNLAN8011626
.ATSCXA 191416 .ATSCXA 191507
CFD CFD
AN .CC-BGL/FI LA0801/MA 826A AN .CC-BGL/FI LA0801/MA 882A
- #CFCFG231500 - #CFEFFDE

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The interface also shows a frequency spectrum on the left side of the main window, with a frequency range from 0.000 to 0.00 MHz. The status bar at the bottom indicates "Decoding" and "HF DL".

5583.0 kHz Auckland Air, New Zealand

Cruise sector data downlink from aircraft CC-BGL (LATAM Airlines Boeing B787-9)

12 hours SC EL - NZAA across the Southern Ocean without an alternate airport ... Note that all those famous flight tracking webpages such as Flightradar 24 have ZERO real-time data for the 10+ hours cruise sector of this flight; they simply visualize some great-circle extrapolation ... while it's all here on HF - updated every 15 minutes - if you know when and where to look! Now you can easily calculate the fuel consumption: 191357 - 191227 = 90 Minutes; 202231 - 194347 = 7884 kg corresponding to the rounded 43500 - 35500 = 8 tons; this makes around 5 tons per hour up there at FL 360 - FL 380 ... See our hotfrequencies webpage for the explanation of very special abbreviations, procedures and terms - particularly for avionics - and a primer on ATS Facilities Notification, codes of FIRs providing data link services - different from ICAO location indicators! -, and codes of ACARS and HF DL Message Labels • The Basic or Periodic Report gives position - trajectory intent - speed vector data plus the Figure of Merit code or data for navigational accuracy • TS = Time Stamp 19 APR 2022 1504 UTC

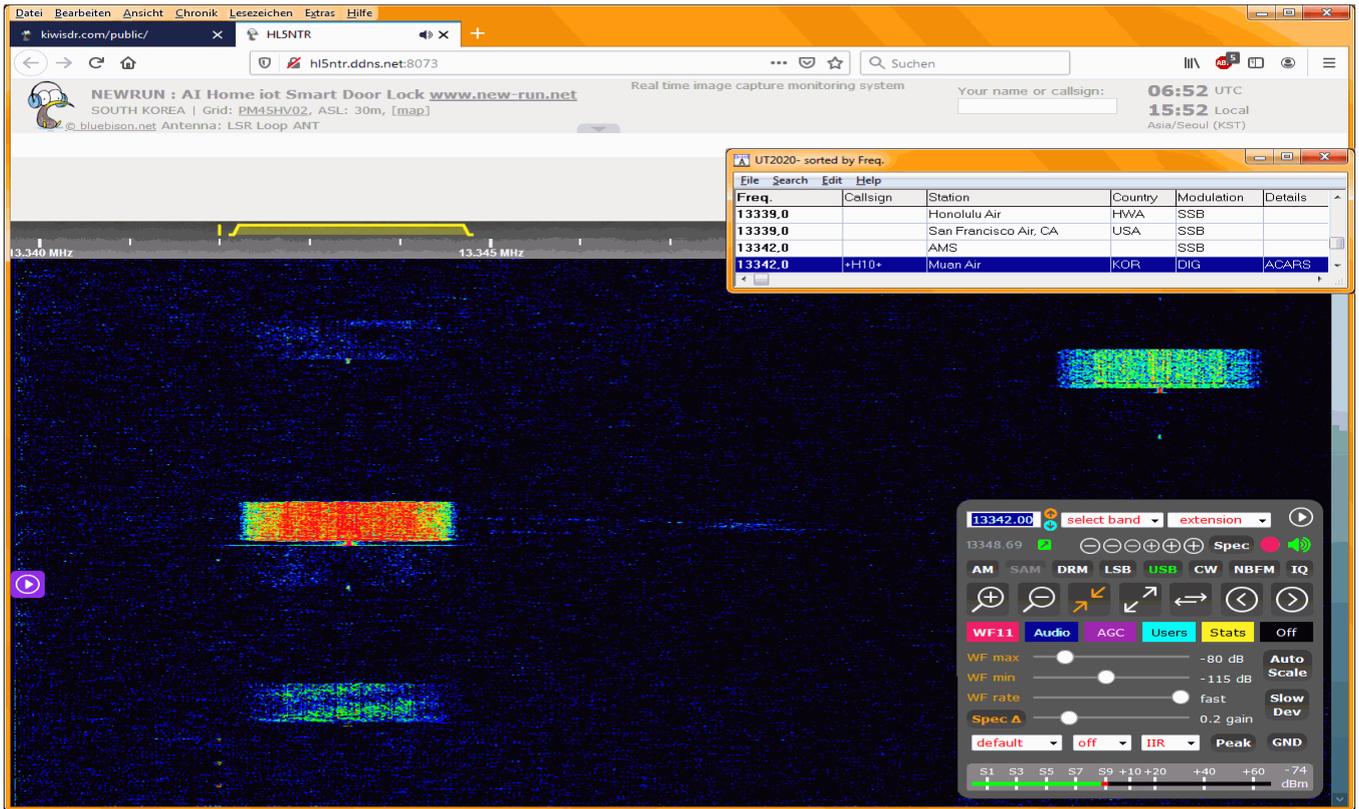
2.9 Internet-controlled Software-Defined Radios (Web-SDR)

In urban areas all over the world, shortwave radio listeners experience an increasing level of man-made noise by around-the-corner and in-house digital techniques such as cheap electronic goods from China, powerline communication (PLC), plasma television screens, and so on. The radio spectrum is polluted, and that makes HF reception impossible in certain places. Constructing a state-of-the-art listening post far away in the "quiet" countryside, and controlling it via the Internet, is the optimal solution to this problem that has been successfully adapted by e.g. Christoph Ratzer OE2CRM in Austria. His Remote DX Blog at <https://remotedx.wordpress.com> reports incredible receptions from far-away and weak shortwave (and mediumwave!) broadcast radio stations all over the world.

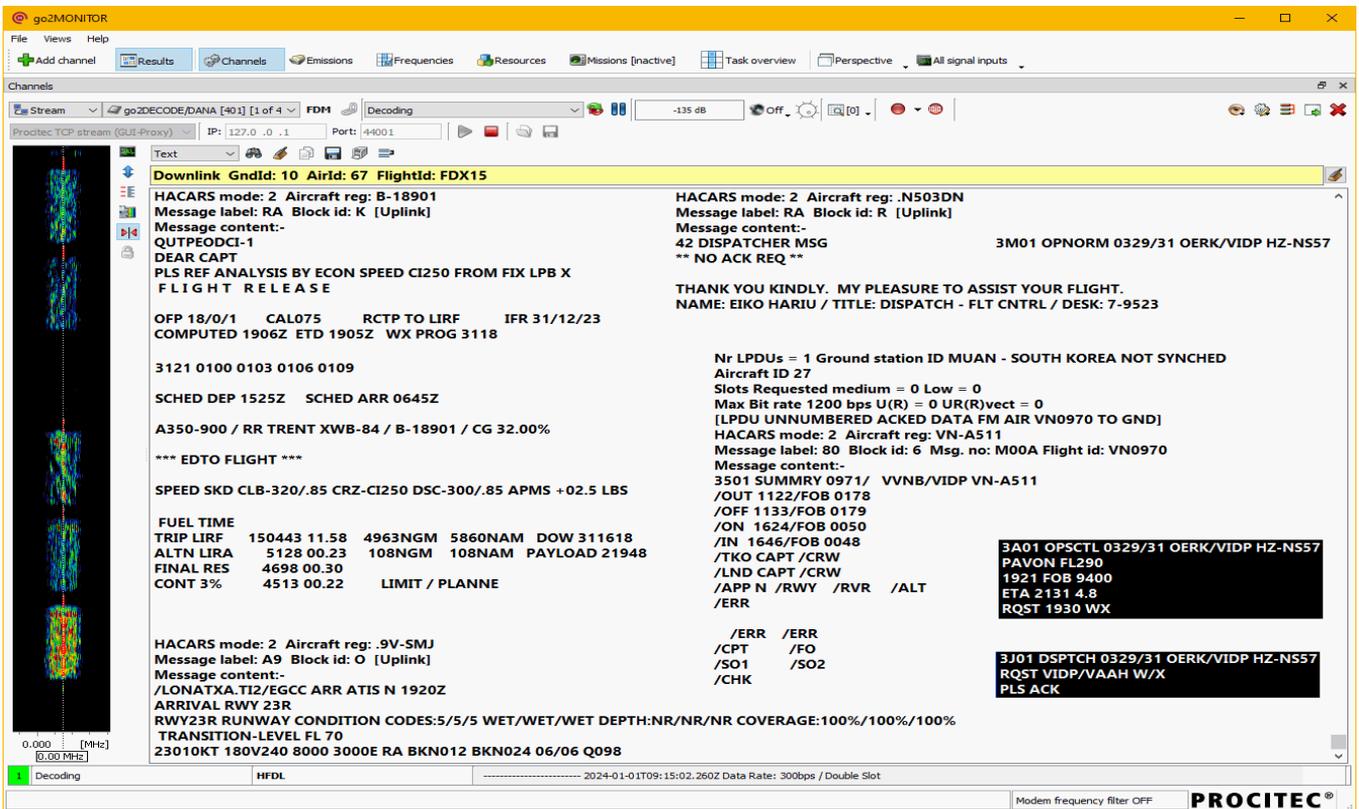
Fortunately, there's a much less expensive solution. Currently (2024), **more than six hundred (!) Kiwi-SDRs worldwide covering the complete 0-30 MHz spectrum are linked at www.kiwisdr.com and www.ve3sun.com/KiwiSDR**. This is the Open Web RX project of András Retzler HA7ILM with the superb Kiwi-SDR user interface for the Beagle Bone computer board. It is simply great for the reception of HF utility radio stations, and even NAVTEX on MF, from interesting locations all over the world. What's more, many radio amateurs, radio clubs, researchers, and universities have made available their SDRs via Internet. Dozens of such projects are linked e.g. at www.websdr.org. The frequency bands covered are usually certain amateur radio bands \pm a few kHz beyond. Consequently, the antennas used are optimized for these bands, and their performance decreases sharply for frequencies beyond. Anyway, a good starting point is the University of Twente's Web-SDR in the Netherlands that covers the entire MF and HF band from 0 to 29 MHz.

The screenshot shows the go2MONITOR software interface. The main window displays a waterfall plot on the left and a text decoder on the right. The decoder shows a message in Portuguese from the Brazilian Navy, including a weather forecast (BOLETIM DE PREVISAO METEOROLOGICA ESPECIAL) and a situation report (ALFA - SITUACAO SINOTICA EM 241200 HMG NIL). A 'General' settings window is open, showing parameters like Modulation (FSK-2), Symbol rate (200.0 Bd), and Transmission type (USB). The interface includes various toolbars and a status bar at the bottom.

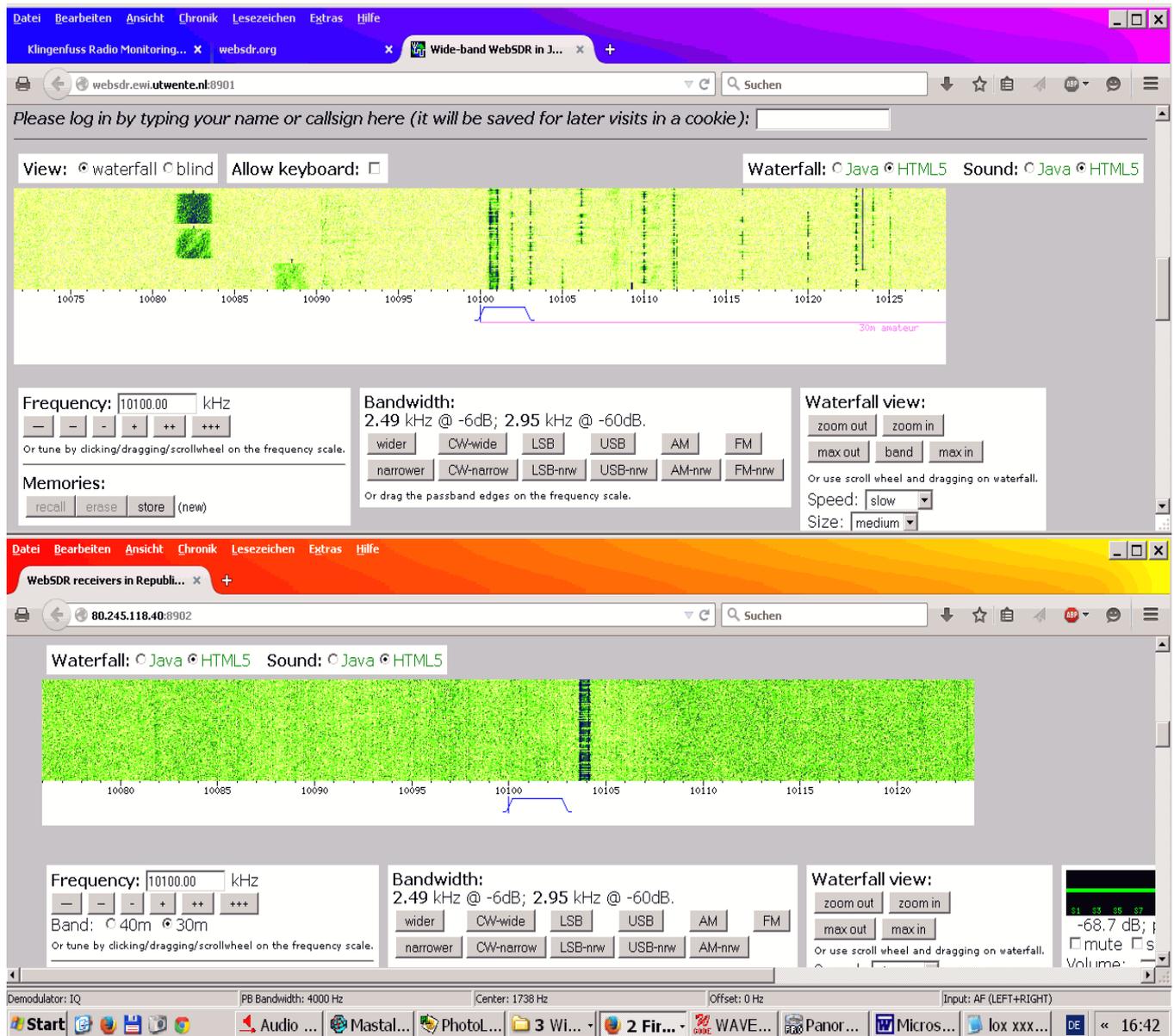
go2SIGNALS' superb DANA allows direct input of a Kiwi-SDR signal (here ex PT2FHC) into the go2MONITOR decoder • Up to 32 decoding channels are provided!
 A specially formatted sample Klingenfuss frequency database is perfectly integrated in the go2MONITOR GUI • 16984.0 kHz Brazilian Navy Rio de Janeiro, Brazil



Kiwi-SDR in Daegu, South Korea (left: Muan 13342.0 kHz - right: Auckland 13351.0 kHz)
Perfect HFDL PSK-aggregate data bursts - note the pilot tone at 1440 Hz!



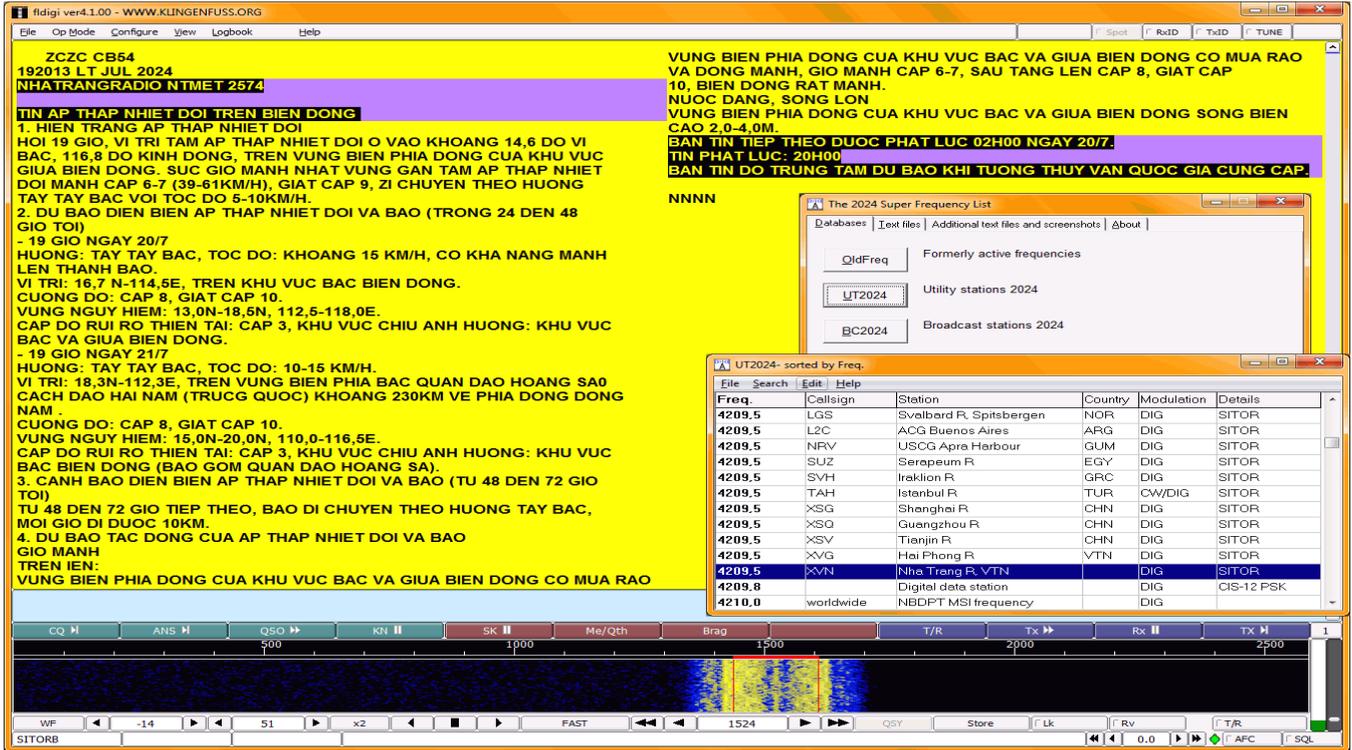
Perfect decoding of the Kiwi-SDR's signal above
10060.0 kHz Muan Air, South Korea



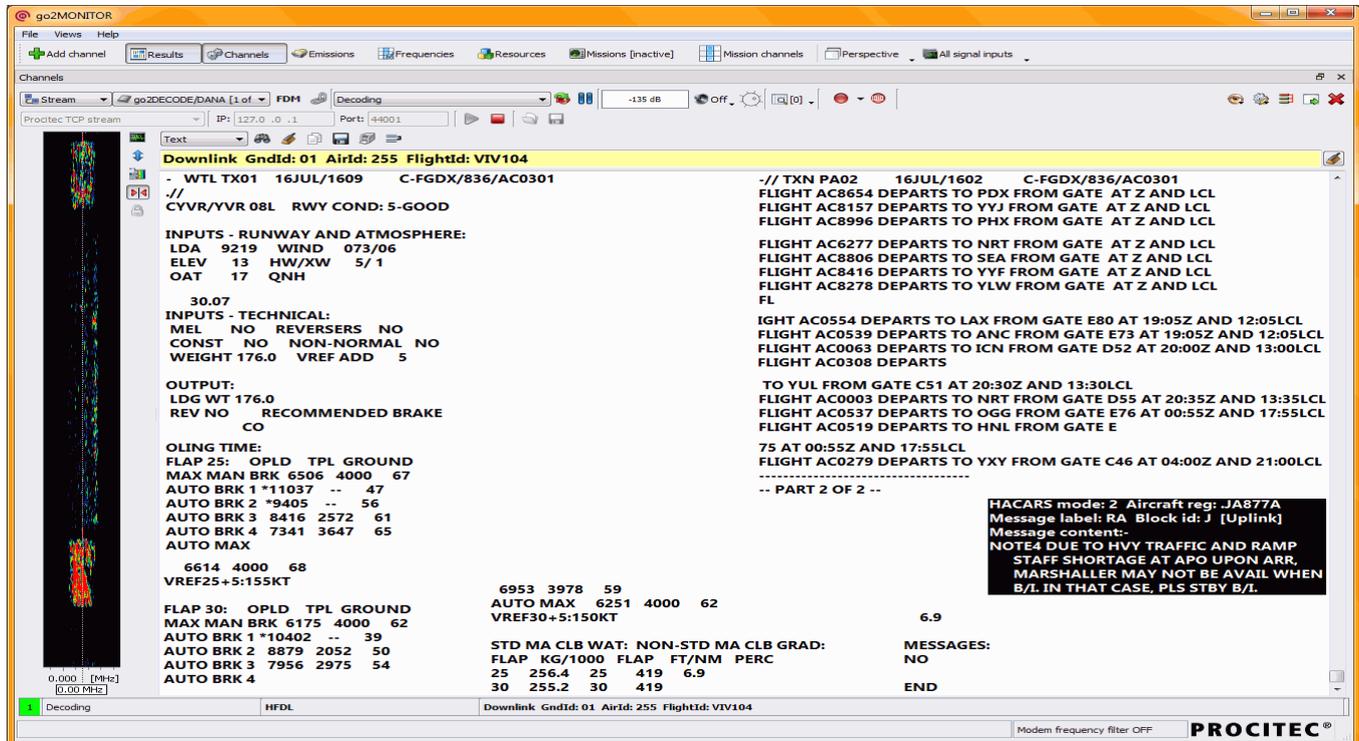
Web-SDRs Twente, Netherlands, and Crimea, Russian Federation

This screenshot - made 7 March 2015 at 1642 UTC - shows the difference between a professional project like Twente, above, and an amateur project elsewhere, below. The strong FSK signal in the centre of the spectrum is Hamburg Meteo on 10100.8 kHz. On the right is the amateur radio band with many digital signals. On the left is the aeronautical mobile band with HF DL aggregate bursts at 10081 kHz USB (Shannon), and 10087 kHz USB (Krasnoyarsk). On the other hand, Crimea is as deaf as a dodo: it receives just Hamburg and nothing else, neither in the amateur band nor in the aeronautical band where Krasnoyarsk would be just one propagation hop away ... What's more, the frequency displayed is 3 kHz too high!

Twente is often accessed by 400+ users at the same time. It allows perfect decoding of sophisticated digital data signals, even if your Internet connection delivers only a real-life data rate of 400-500 kB/s. A chatbox allows a discussion of the project, and comments on the stations received. At <http://websdr.ewi.utwente.nl:8901/m.html>, there is a Web-SDR version for mobile devices such as smartphones and tablet computers. Be sure to use the latest versions of modern browsers such as Chrome, and select HTML5 instead of Java.

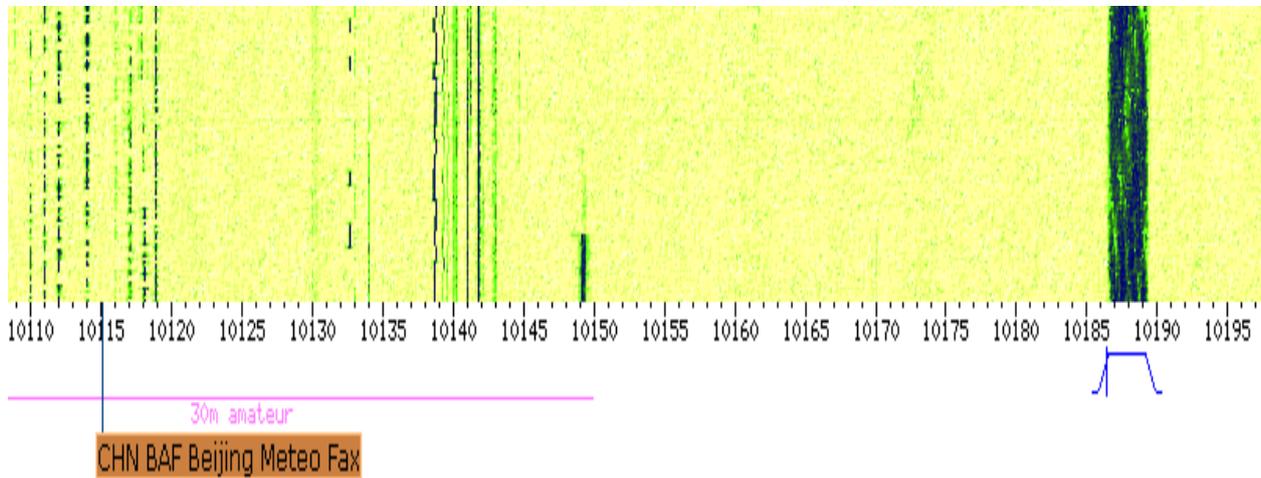


Kiwi-SDR Hanoi, Viet Nam
4209.5 kHz Nha Trang Radio, Viet Nam



Kiwi-SDR Keelung, Taiwan, Democratic Republic of China
6559.0 kHz San Francisco Air CA, United States of America
Vancouver runway 08L landing data and transfer flight connections uplink
to aircraft C-FGDY (Air Canada Boeing B787-9)
Tokyo-Narita ramp chaos uplink to aircraft JA877A (All Nippon Airways Boeing B787-9)

Just for the record ... the "Station information" from certain databases displayed in some Web-SDR's "Frequency labels" is totally outdated and misleading. It includes hundreds and thousands of users that ceased transmissions on HF several decades ago. What's more, most radio amateurs simply do not know even the most common professional digital data modes, stations, and frequencies ...



**"CHN BAF Beijing Meteo Fax" on 10117 (not 10115!) kHz closed way back in 2002 ...
while real-time data such as the strong FUG PSK aggregate on 10187.9 kHz
is listed only in up-to-date publications such as our
GUIDE TO UTILITY RADIO STATIONS - Professional HF Communication Today
and on our SUPER FREQUENCY LIST ON CD!**

For standard digital data transmission systems, the required data rates on your e.g. SDR ↔ PC ↔ Internet ↔ WebSDR connection are not too demanding. Example: Recording WAV files from a Web-SDR. With the channel bandwidth set to around 3 kHz for e.g. PACTOR-FEC, the data amounts to approximately 930 kB/min or 16 kB/s. This means that even complex PSK aggregate signals such as STANAG 4285 - let alone 10-kHz-wide DRM! - do require just a few dozen kB/s which is easily achieved with even those "slow" DSL connections somewhere in the countryside.

Name ▲

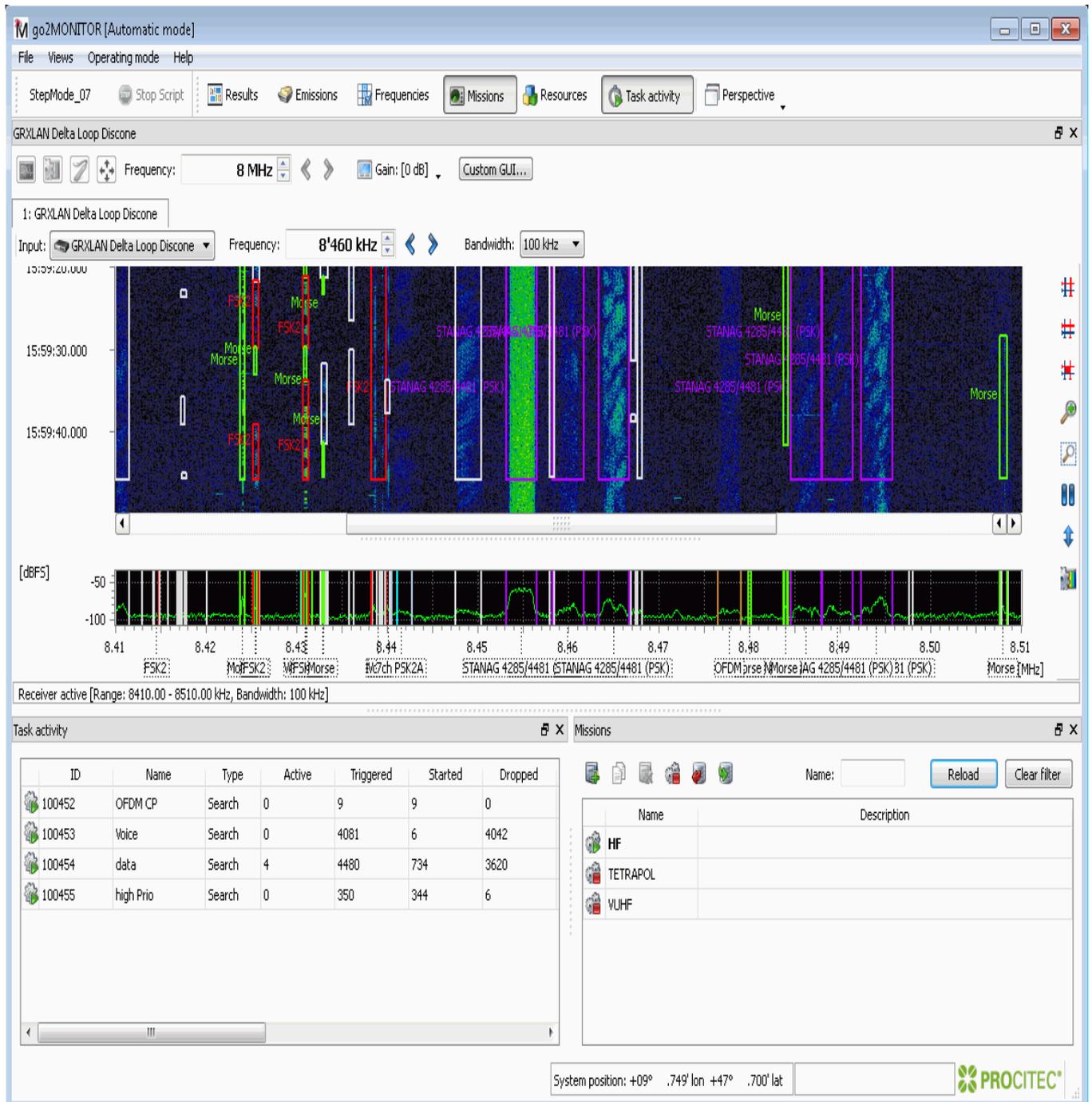
 websdr_recording_2015-04-10T09_11_55Z_6449.0kHz

websdr_recording_2015-04-10T09_11_55Z_6449.0kHz
 Typ: VLC media file (.wav)
 Bitrate: 128 kBit/s
 Größe: 2,18 MB

2:23 minutes Web-SDR recording Brazil ↔ Germany

2.10 Automatic monitoring using wide-band SDRs

State-of-the-art radio monitoring tools now allow continuous automatic classification of emissions monitored over a wide frequency spectrum.



PROCITEC go2MONITOR displays a 100 kHz wide sonagram between 8410 and 8510 kHz and continuously classifies all emissions in realtime

All those fascinating digital data signals visible here in the sonagram are perfectly identified and listed in our latest publications!

The screenshot displays the configuration window for a mission named "PACTOR-2-FEC scan". The window is divided into several sections:

- Summary:** Task overview.
- General:**
 - Type: Wideband Signal Search with Live Processing
 - Name: PACTOR-2-FEC scan
 - Description:
 - Priority: Normal
 - Enabled: Yes
- Activation:**
 - Time: No activation criteria
 - Region: 0 regions defined
 - Signal Input: Receiver, Stream or File Input
 - Frequencies: 1 frequencies defined. Includes "FrequencyRange_1, 4.0000 MHz - 25.0000 MHz, Search".
- Start Trigger:**
 - Modem: PACTOR II FEC
 - Modem trigger type: Trigger if not excluded
 - Energy: snr: >10, Bandwidth from: 0, Bandwidth to: 5000
 - Triggering from wideband classifier emissions
- Actions:**
 - Live processing:
 - Narrowband channel configuration: default
 - Signal processing duration: 30 s
 - Use modem list from trigger: Yes
 - Using channel type: All channels
 - Allow fast triggering from classification results
- Settings (Result Storage):**
 - Delete results automatically
 - Delete non-archived results after: 120 days
 - Delete archived results after: 120 days
- Mission Details:**
 - Name: PACTOR-2-FEC scan
 - Use production channels in: Realtime mode
 - Use GUI perspective: JK
- Tasks:**
 - Buttons: Add, Edit, Delete, Refresh, Stop
 - Task list:
 - Name: JK
 - PACTOR-2-FEC scan
 - Enabled

Mission activation and task definition with the go2MONITOR decoder allows specified search for e.g. strange PACTOR-2-FEC signals monitored only recently in certain maritime bands

2.11 Direction-finding using the Kiwi-SDR system

The location of unidentified radio stations can now be measured with a precision of up to 5 - 10 kilometres. This Kiwi-SDR software feature is called Time Difference on Arrival (TDOA). Similar to the established GPS system, it measures the time-difference of signals received from at least three radio stations and, via cross correlation, calculates the geographical location on the Earth's surface by simple triangulation. (Note that GPS requires at least four satellites for calculating the altitude as well.) The following screenshots demonstrate the complete workflow.

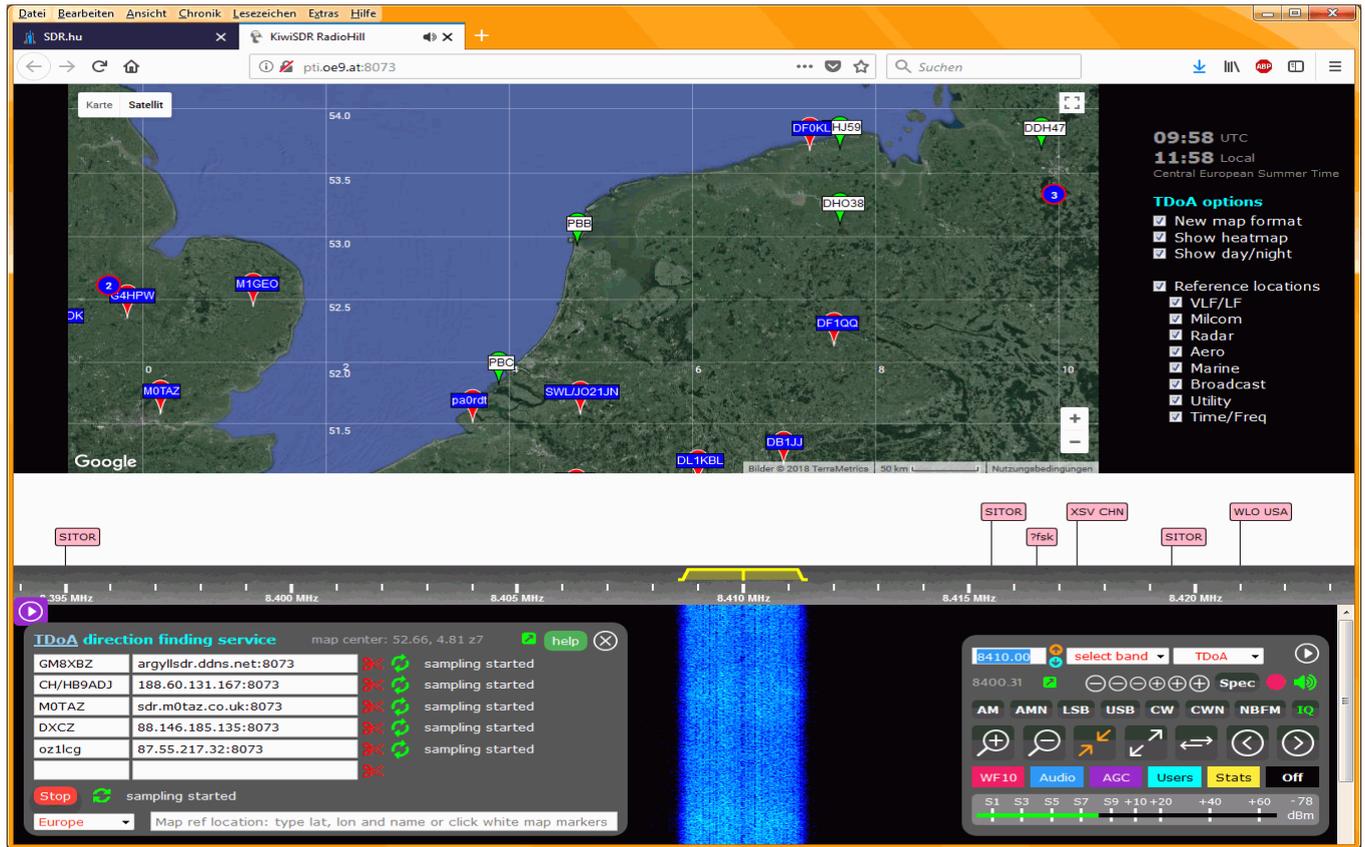
The screenshot displays the Kiwi-SDR software interface. At the top, there is a menu bar with options like 'Datei', 'Bearbeiten', 'Ansicht', 'Chronik', 'Lesezeichen', 'Extras', and 'Hilfe'. Below the menu is a browser-like address bar showing 'pti.oe9.at:8073'. The main area is a map of Europe with several radio stations marked with call signs and icons. A search bar is visible in the top right corner. On the right side, there is a panel for 'TDoA options' with checkboxes for 'New map format', 'Show heatmap', 'Show day/night', and 'Reference locations'. Below the map, there is a frequency spectrum view showing a signal at 8.410 MHz. At the bottom, there is a 'TDoA direction finding service' panel with a table of stations and their GPS fix rates.

Call Sign	IP Address	GPS Fixes/Min
GM8XBZ	argyllsdr.ddns.net:8073	29
CH/HB9ADJ	188.60.131.167:8073	30
M0TAZ	sdr.m0taz.co.uk:8073	29
DXCZ	88.146.185.135:8073	30
oz1lcg	87.55.217.32:8073	29

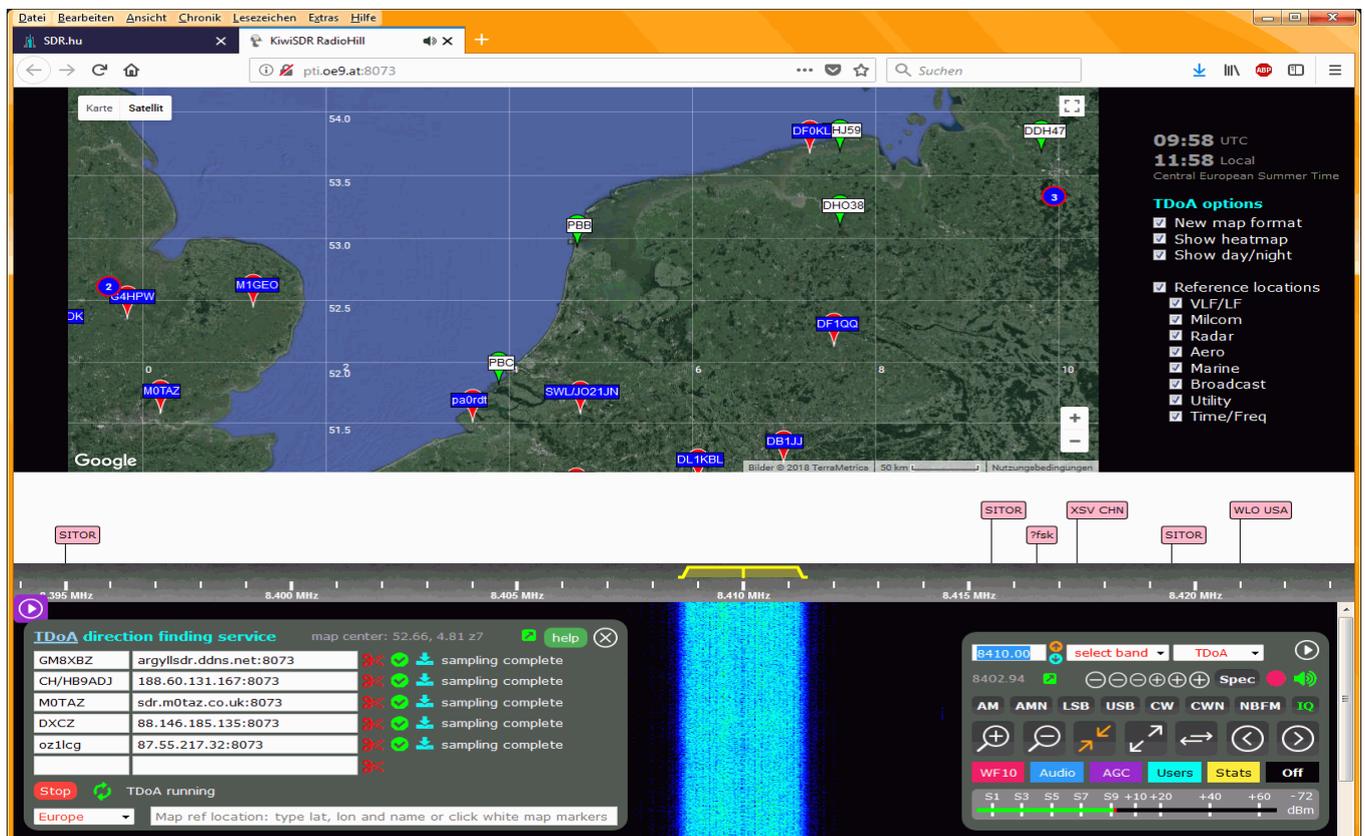
Select In-Phase-and-Quadrature (I/Q) demodulation

Select at least three GPS-locked Kiwi-SDRs around the presumed location

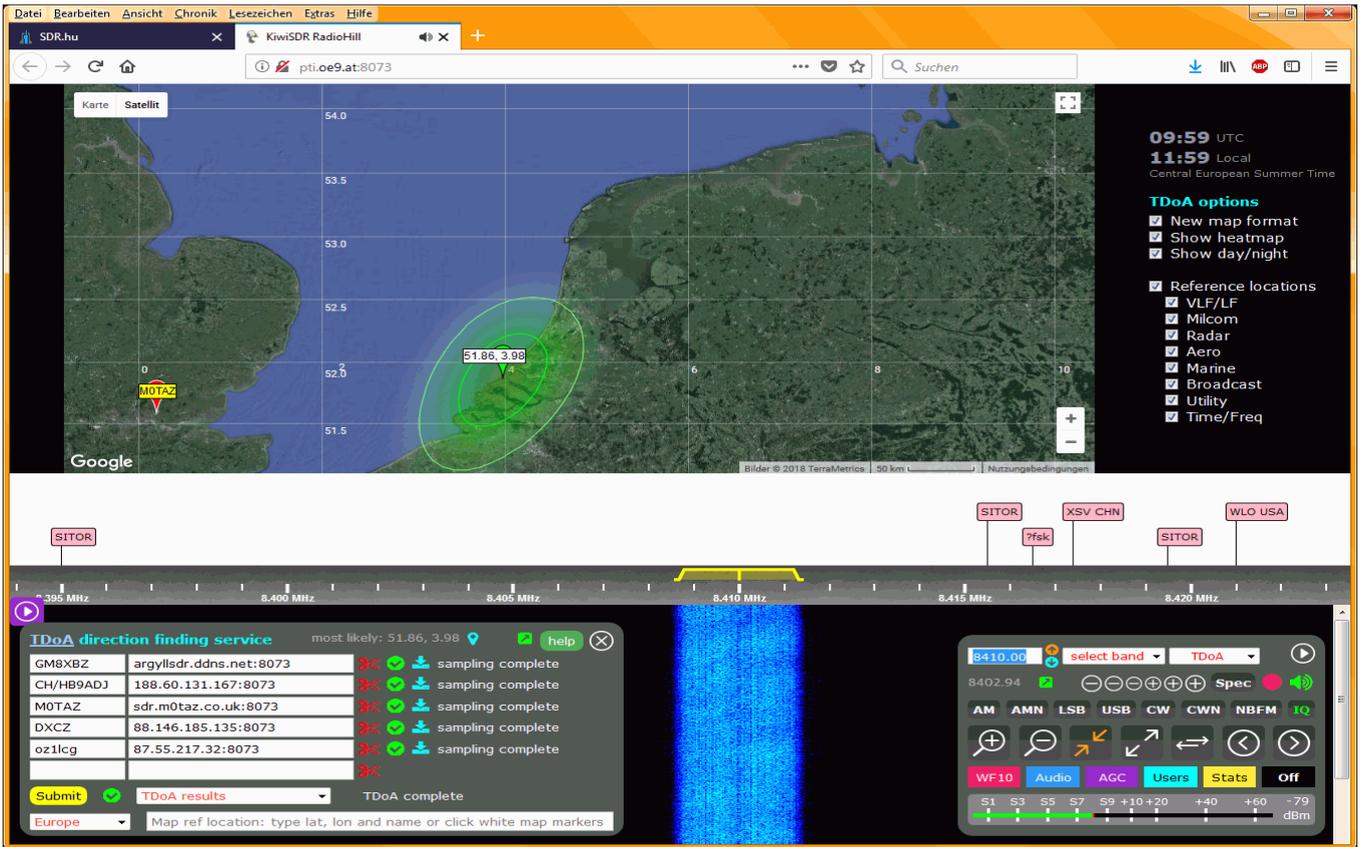
Each of these must provide good reception of the desired signal!



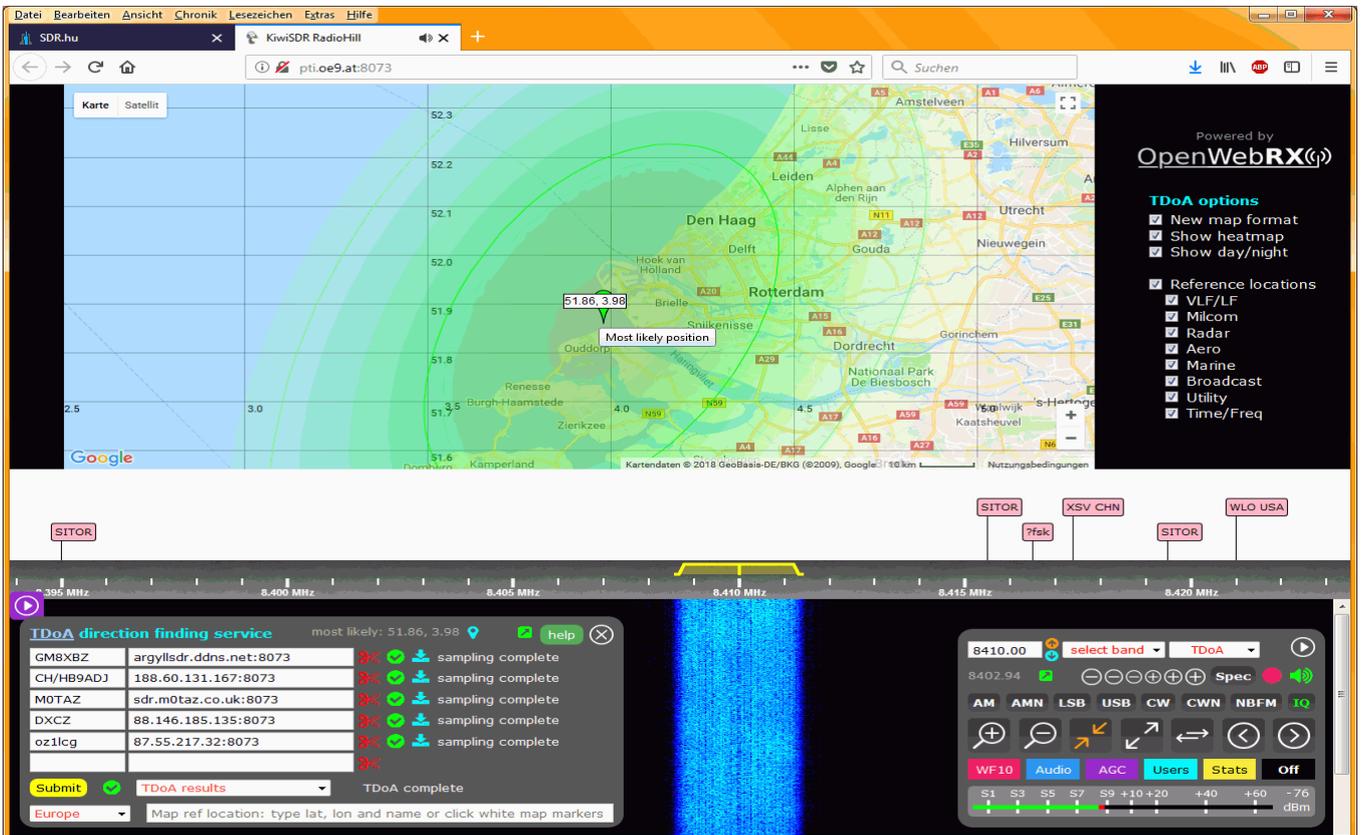
The I/Q data stream sampling process takes around 30 seconds ...



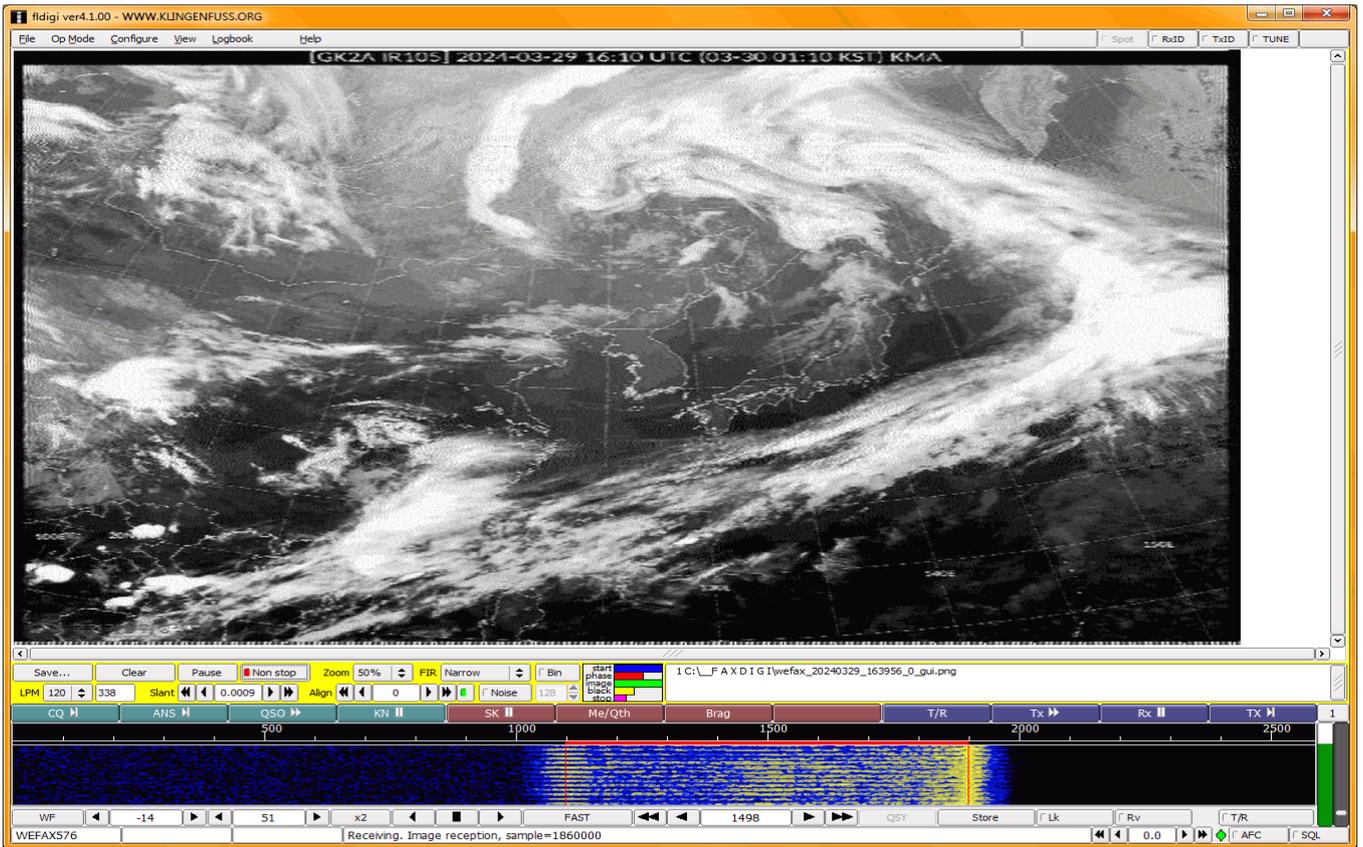
The TDOA calculation process takes 1-2 minutes ...



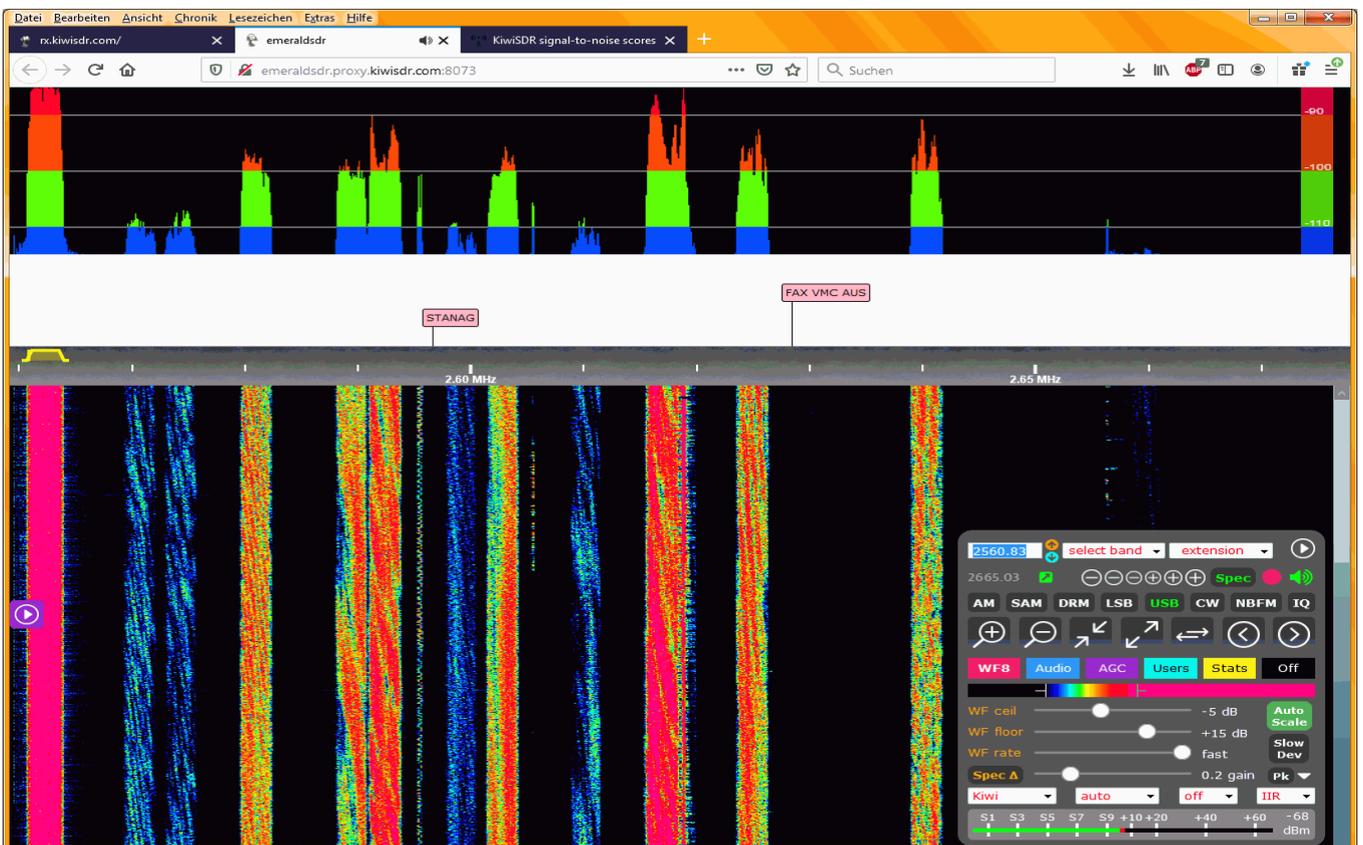
The possible location is shown on the map ...



... and identified as the Dutch Navy on Goeree Island, Netherlands!



9165.0 kHz Soul Meteo, South Korea • Satellite image



2615 ± 50 kHz • many STANAG 4285 signals on a Kiwi-SDR ☺